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Dresden Generating Station
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ComEd

December 2, 1997

JSPLTR: # 97-0207

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555
ATTN: Document Control Desk

Subject: Dresden Nuclear Power Station Units 2 and 3
Correction to UFSAR Update Revision 2, Dated June 30, 1997
NRC Docket Numbers 50-237 and 50-249

Reference: a. Letter from J. S. Perry to NRC Document Control Desk dated November 18, 1997 transmitting Revision 2a of the Dresden UFSAR

b. Letter from J. S. Perry to NRC Document Control Desk dated June 30, 1997 transmitting Revision 2 of the Dresden UFSAR

The purpose of this letter is to reissue reference (a) to ensure its proper distribution. The entire text of reference (a) is repeated below.

This letter transmits Revision 2a of the Dresden Updated Final Safety Analysis Report (UFSAR). Revision 2a is a reissuance of several pages of the UFSAR to correct word processing and publication errors.

Prior to Revision 2, Dresden Station maintained two copies of the UFSAR, one for offsite use and a ComEd copy that included a series of footnotes to assist personnel in UFSAR research. To prevent the possibility of introducing inconsistencies between the two versions, a decision was made to issue only one UFSAR version. This was transmitted by Reference (b) as UFSAR Revision 2 and included changes to the facility and its procedures through December 31, 1996. Subsequent to the issuance of Revision 2, it was determined that there were pagination differences between the two word processing files which introduced potential text formatting issues. Following this discovery, a line-by-line verification was conducted of the published UFSAR. This review identified approximately 20 pages requiring pagination corrections.

Revision 2a consists of corrected pages only. There were no additional text revisions beyond the package submitted as Revision 2. Where Revision 2a pages replace Revision 2 pages, the revision bar on the Revision 2a page reflects the changes made in Revision 2 of the UFSAR.

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The attached update instructions summarize the changes and provide instructions for entering the revised pages. Revision 2a is submitted on a replacement page basis. Please discard the replaced pages and insert the Revision 2a pages as directed in the attached instructions.

Pursuant to 10 CFR 50.4 (b) (6), one (1) signed original and ten (10) copies are being provided to the Document Control Desk, plus one (1) copy to the NRC region III office and one (1) copy to the Dresden Senior Resident Inspector Office.

Please address any questions or comments regarding this submittal to Mr. Frank Spangenberg, Regulatory Assurance Manager, at (815) 942-2920, extension 3800.

Sincerely,

J. Stephen Perry
Site Vice President
Dresden Station

Enclosure

cc: A. Bill Beach, Regional Administrator, Region III (W/ enclosure)
M. Ring, Branch Chief, DRP, Region III (W/O enclosure)
J. F. Stang, Project Manager, NRR (W/O enclosure)
Senior Resident Inspector, Dresden (W/ enclosure)
Office of Nuclear Facility Safety - IDNS (W/ enclosure)

bcc: Regulatory Services Manager (Hard Copy) (W/O enclosure)
Nuclear Licensing Administrator (Electronic Copy) (W/O enclosure)
ComEd Document Control Desk Licensing (Hard Copy) (W/O enclosure)
ComEd Document Control Desk Licensing (Electronic Copy) (W/O enclosure)
Dresden Regulatory Assurance, CHRON File (W/O enclosure)
Site VP Numerical File (W/O enclosure)

Dresden UFSAR Update Instructions
Revision 2a

Identification of Page(s)	Remove	Insert	Notes
List of Effective Pages	Revision 2	Revision 2a	List of effective pages showing Revision 2a changes
table 3.8-1	Revision 2	Revision 2a	Addition of Revision level to page
3.9-30	current page	Revision 2a	Addition of Revision level to page
table 3.11-3 sheets 1 - 3	Revision 2	Revision 2a	Replacement table to improve clarity.
5.2-19	Revision 2	Revision 2a	Addition of Revision bar to page
6.2-15	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
6.2-16	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
6.2-17	Revision 01A	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
6.2-18	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
6.2-19	Revision 2	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
6.2-47	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.

6.2-65	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
6.2-76	Revision 2	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
8.3-26	Revision 01A	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
9.3-2	Revision 2	Revision 2a	replacement page to improve print quality
9.3-3	Revision 2	Revision 2a	addition of text line inadvertently deleted due to pagination
9.5-9	current page	Revision 2a	Addition of Revision level to page
12.5-5	Revision 2	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
13.5-4	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
13.5-7	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
13.5-9	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
13.5-10	Revision 0	Revision 2a	Re-issuance of page to correct pagination , no Revision to existing text.
15.6-20	Revision 0	Revision 2a	Corrected an overprint created on an original Rev 0 page

LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2a

This List of Effective Pages identifies those text pages, tables and figures that are currently effective in the FSAR.

Page/Table/Figure No.	Revision
1-i	2
1-ii	2
1-iii	0
1-iv	0
1.1-1	0
1.1-2	0
1.1-3	0
T 1.1-1 Sheet 1	0
T 1.1-1 Sheet 2	0
T 1.1-1 Sheet 3	2
1.2-1	0
1.2-2	0
1.2-3	2
1.2-3a	2
1.2-4	2
1.2-5	2
1.2-6	2
1.2-6a	2
1.2-7	0
1.2-8	0
1.2-9	0
1.2-10	2
1.2-11	0
1.2-12	0
1.2-13	2
1.2-14	2
1.2-15	0
1.2-16	0
1.2-17	01A
1.2-18	0
1.2-19	01A
1.2-20	0
1.2-20a	2
1.2-21	2
1.2-21a	2
1.2-22	2
1.2-23	0
1.2-24	0
1.2-25	0
T 1.2-1 Sheet 1	0
T 1.2-1 Sheet 2	0
T 1.2-1 Sheet 3	0
T 1.2-1 Sheet 4	0
T 1.2-1 Sheet 5	0
T 1.2-1 Sheet 6	0
T 1.2-1 Sheet 7	0
F 1.2-1	A
F 1.2-2	H
F 1.2-3	H
F 1.2-4	Q
F 1.2-5	H
F 1.2-6	H
F 1.2-7	D
F 1.2-8	C
F 1.2-9	D
F 1.2-10	D
F 1.2-11	0
F 1.2-12	A
F 1.2-13	B
F 1.2-14	C
F 1.2-15	C
F 1.2-16	B
F 1.2-17	B
F 1.2-18	A
F 1.2-19	C
1.3-1	0
1.4-1	0
1.5-1	0
1.6-1	0
1.7-1	0
F 1.7-1	H
F 1.7-2	R
1.8-1	0

LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2
(Continued)

Page/Table/Figure No.	Revision	Page/Table/Figure No.	Revision
T 1.8-1 Sheet 1	2	T 2.2-5	0
T 1.8-1 Sheet 2	2	T 2.2-6	0
T 1.8-1 Sheet 3	2	T 2.2-7 Sheet 1	0
T 1.8-1 Sheet 4	2	T 2.2-7 Sheet 2	0
		T 2.2-7 Sheet 3	0
1.9-1	0	T 2.2-7 Sheet 4	0
1.9-2	0	T 2.2-8 Sheet 1	0
1.9-3	0	T 2.2-8 Sheet 2	0
1.9-4	0	T 2.2-8 Sheet 3	0
		T 2.2-8 Sheet 4	0
2-i	0	T 2.2-8 Sheet 5	0
2-ii	0	T 2.2-8 Sheet 6	0
2-iii	0	T 2.2-8 Sheet 7	0
2-iv	0	T 2.2-8 Sheet 8	0
		T 2.2-8 Sheet 9	0
2.1-1	0	T 2.2-8 Sheet 10	0
2.1-2	0	T 2.2-8 Sheet 11	0
2.1-3	0	T 2.2-8 Sheet 12	0
2.1-4	0	T 2.2-8 Sheet 13	0
2.1-5	0	T 2.2-9	0
		T 2.2-10 Sheet 1	0
T 2.1-1	0	T 2.2-10 Sheet 2	0
T 2.1-2	0	T 2.2-10 Sheet 3	0
		T 2.2-11	0
F 2.1-1	0		
F 2.1-2	0	F 2.2-1	0
		F 2.2-2	0
2.2-1	0		
2.2-2	0	2.3-1	0
2.2-3	0	2.3-2	2
2.2-4	0	2.3-3	0
2.2-5	0	2.3-4	0
2.2-6	0		
2.2-7	0	T 2.3-1	0
2.2-8	0	T 2.3-2	0
2.2-9	0		
2.2-10	0	2.4-1	01A
2.2-11	0	2.4-2	0
		2.4-3	01A
T 2.2-1 Sheet 1	0	2.4-4	0
T 2.2-1 Sheet 2	0	2.4-5	0
T 2.2-2	0	2.4-6	0
T 2.2-3 Sheet 1	0	2.4-7	0
T 2.2-3 Sheet 2	0		
T 2.2-4	0	T 2.4-1	01A

LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2
(Continued)

Page/Table/Figure No.	Revision	Page/Table/Figure No.	Revision
F 2.4-1	0	3.1-25	0
F 2.4-2	0	3.1-26	0
F 2.4-3	0	3.1-27	0
		3.1-28	0
2.5-1	0	3.1-29	0
2.5-2	0	3.1-30	0
2.5-3	0	3.1-31	0
2.5-4	0	3.1-32	0
		3.1-33	0
Appendix 2A	0	3.1-34	0
		3.1-35	0
3-i	0	3.1-36	0
3-ii	0	3.1-37	0
3-iii	2	3.1-38	0
3-iv	2	3.1-39	0
3-v	0	3.1-40	0
3-vi	2	3.1-41	0
3-vii	2	3.1-42	0
3-viii	2	3.1-43	2
3-ix	2	3.1-44	2
		3.1-45	0
3.1-1	01A	3.1-46	0
3.1-2	0	3.1-47	0
3.1-3	0	3.1-48	0
3.1-4	0	3.1-49	0
3.1-5	0	3.1-50	0
3.1-6	0	3.1-51	0
3.1-7	0	3.1-52	0
3.1-8	0	3.1-53	0
3.1-9	0	3.1-54	0
3.1-10	0	3.1-55	0
3.1-11	0	3.1-56	0
3.1-12	0	3.1-57	0
3.1-13	0	3.1-58	0
3.1-14	0	3.1-59	0
3.1-15	0	3.1-60	0
3.1-16	0	3.1-61	0
3.1-17	0	3.1-62	0
3.1-18	0	3.1-63	0
3.1-19	0	3.1-64	0
3.1-20	0	3.1-65	0
3.1-21	0	3.1-66	0
3.1-22	0	3.1-67	0
3.1-23	0	3.1-68	0
3.1-24	0	3.1-69	0

LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2
(Continued)

Page/Table/Figure No.	Revision	Page/Table/Figure No.	Revision
3.2-1	0	3.5-14	0
3.2-2	0	3.5-15	0
3.2-3	0	3.5-16	0
3.2-4	0		
3.2-5	0	T 3.5-1 Sheet 1	0
3.2-6	0	T 3.5-1 Sheet 2	0
3.2-7	2	T 3.5-2	0
3.2-8	2	T 3.5-3	0
3.2-9	0	T 3.5-4	0
		T 3.5-5	0
3.3-1	0	T 3.5-6	0
3.3-2	0		
3.3-3	0	F 3.5-1	0
3.3-4	0	F 3.5-2	0
3.3-5	0		
3.3-6	0	3.6-1	0
3.3-7	0	3.6-2	0
3.3-8	01A	3.6-3	0
3.3-9	0	3.6-4	0
3.3-10	0	3.6-5	0
		3.6-6	0
F 3.3-1	0	3.6-7	0
F 3.3-2	0	3.6-8	0
		3.6-9	0
3.4-1	0	3.6-10	0
3.4-2	0	3.6-11	0
3.4-3	0	3.6-12	0
3.4-4	0	3.6-13	0
3.4-5	0	3.6-14	0
3.4-6	0		
3.4-7	2	3.7-1	2
		3.7-2	2
3.5-1	0	3.7-3	01A
3.5-2	0	3.7-4	0
3.5-3	0	3.7-5	2
3.5-4	0	3.7-5a	2
3.5-5	0	3.7-6	2
3.5-6	0	3.7-7	0
3.5-7	0	3.7-8	0
3.5-8	0	3.7-9	0
3.5-9	2	3.7-10	0
3.5-10	0	3.7-11	0
3.5-11	0	3.7-12	0
3.5-12	0	3.7-13	0
3.5-13	0	3.7-14	0

LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2
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Page/Table/Figure No.	Revision
3.7-15	0
3.7-16	0
3.7-17	0
3.7-18	0
3.7-19	0
3.7-20	0
3.7-21	0
3.7-22	2
3.7-23	0
3.7-24	0
3.7-25	2
T 3.7-1	2
T 3.7-2	0
T 3.7-3	0
T 3.7-4	0
T 3.7-5	0
T 3.7-6	0
F 3.7-1	0
F 3.7-2	0
F 3.7-3	0
F 3.7-4	0
F 3.7-5	0
F 3.7-6	2
F 3.7-7	0
F 3.7-8	0
F 3.7-9	0
F 3.7-10	0
F 3.7-11	0
F 3.7-12	0
F 3.7-13	0
F 3.7-14	0
3.8-1	0
3.8-2	2
3.8-3	0
3.8-4	0
3.8-5	2
3.8-6	2
3.8-7	2
3.8-7-a	2
3.8-8	2
3.8-9	0
3.8-10	0
3.8-11	0
3.8-12	0
3.8-13	0
3.8-14	0
3.8-15	0
3.8-16	0
3.8-17	0
3.8-18	0
3.8-19	0
3.8-20	0
3.8-21	0
3.8-22	2
3.8-23	0
3.8-24	0
3.8-25	0
3.8-26	0
3.8-27	0
3.8-28	0
3.8-29	0
3.8-30	0
T 3.8-1	2a
T 3.8-2	01A
T 3.8-3	2
T 3.8-4 Sheet 1	0
T 3.8-4 Sheet 2	0
T 3.8-4 Sheet 3	01A
T 3.8-5 Sheet 1	0
T 3.8-5 Sheet 2	0
T 3.8-5 Sheet 3	0
T 3.8-6	0
T 3.8-7 Sheet 1	0
T 3.8-7 Sheet 2	0
T 3.8-8	0
T 3.8-9 Sheet 1	0
T 3.8-9 Sheet 2	0
T 3.8-10 Sheet 1	0
T 3.8-10 Sheet 2	0
T 3.8-11	0
T 3.8-12	0
F 3.8-1	0
F 3.8-2	0
F 3.8-3	0
F 3.8-4	0

LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2
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Page/Table/Figure No.	Revision	Page/Table/Figure No.	Revision
F 3.8-5	0	3.9-2	0
F 3.8-6	0	3.9-2a	2
F 3.8-7	0	3.9-3	2
F 3.8-8	0	3.9-4	0
F 3.8-9A	2	3.9-4a	2
F 3.8-9B	2	3.9-5	2
F 3.8-10	0	3.9-6	2
F 3.8-11	0	3.9-7	2
F 3.8-12	0	3.9-8	2
F 3.8-13	0	3.9-8a	2
F 3.8-14	0	3.9-9	2
F 3.8-15	0	3.9-10	2
F 3.8-16	0	3.9-11	0
F 3.8-17	0	3.9-12	0
F 3.8-18	0	3.9-13	0
F 3.8-19	0	3.9-14	0
F 3.8-20	0	3.9-15	0
F 3.8-21	0	3.9-16	0
F 3.8-22	0	3.9-17	0
F 3.8-23	0	3.9-18	0
F 3.8-24	0	3.9-19	0
F 3.8-25	0	3.9-20	0
F 3.8-26	0	3.9-21	0
F 3.8-27	0	3.9-22	0
F 3.8-28	0	3.9-23	0
F 3.8-29	0	3.9-23a	2
F 3.8-30	0	3.9-24	2
F 3.8-31	0	3.9-25	2
F 3.8-32	0	3.9-25a	2
F 3.8-33	0	3.9-26	0
F 3.8-34	0	3.9-27	0
F 3.8-35	0	3.9-28	0
F 3.8-36	0	3.9-29	0
F 3.8-37	0	3.9-30	2a
F 3.8-38	0	3.9-30a	2
F 3.8-39	0	3.9-31	2
F 3.8-40	0	3.9-31a	2
F 3.8-41	0	3.9-32	0
F 3.8-42	0	3.9-33	2
F 3.8-43	0	3.9-33a	2
F 3.8-44	0	3.9-34	0
F 3.8-45	0	3.9-35	0
F 3.8-46	0	3.9-36	0
		3.9-37	2
3.9-1	0	3.9-37a	2

LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2
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LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2
(Continued)

Page/Table/Figure No.	Revision	Page/Table/Figure No.	Revision
Appendix 3C	0	4.3-5	0
		4.3-6	0
4i	0	4.3-7	0
4ii	2	4.3-8	0
4iii	0	4.3-9	0
4iv	0	4.3-10	0
4v	0	4.3-11	2
		4.3-12	0
4.1-1	0	4.3-13	0
4.1-2	0	4.3-14	0
		4.3-15	0
T 4.1- Sheet 1	0	4.3-16	0
T 4.1- Sheet 2	0	4.3-17	0
T 4.1-2	2	4.3-18	0
T 4.1-3	2	4.3-19	0
		4.3-20	0
4.2-1	0	4.3-21	0
4.2-2	0	4.3-22	0
4.2-3	0	4.3-23	0
4.2-4	0	4.3-24	0
4.2-5	0	4.3-25	2
4.2-6	0	4.3-26	2
4.2-7	0		
4.2-8	0	T 4.3-1	0
4.2-9	0	T 4.3-2	0
4.2-10	0	T 4.3-3	0
4.2-11	0	T 4.3-4	0
4.2-12	2	T 4.3-5	0
4.2-12a	2	T 4.3-6	0
4.2-13	0		
4.2-14	0	F 4.3-1	0
4.2-15	0	F 4.3-2	0
		F 4.3-3	0
T 4.2-1	0	F 4.3-4	0
T 4.2-2	0	F 4.3-5	0
		F 4.3-6	0
F 4.2-1	0	F 4.3-7	0
F 4.2-2	0	F 4.3-8	0
F 4.2-3	0	F 4.3-9	0
		F 4.3-10	0
4.3-1	2	F 4.3-11	0
4.3-2	0	F 4.3-12	0
4.3-3	0	F 4.3-13	0
4.3-4	2	F 4.3-14	0
4.3-4a	2	F 4.3-15	0

LIST OF EFFECTIVE PAGES
CURRENT THROUGH REVISION 2
(Continued)

Page/Table/Figure No.	Revision	Page/Table/Figure No.	Revision
F 4.3-16	0	F 4.4-2	0
F 4.3-17	0	F 4.4-3	0
F 4.3-18	0	F 4.4-4	0
F 4.3-19	0	F 4.4-5	0
F 4.3-20	0		
F 4.3-21	0	4.5-1	2
F 4.3-22	0	4.5-2	0
F 4.3-23	0	4.5-3	0
F 4.3-24	0		
F 4.3-25	0	4.6-1	0
F 4.3-26	0	4.6-2	0
F 4.3-27	0	4.6-3	2
F 4.3-28	0	4.6-4	0
F 4.3-29	0	4.6-5	2
F 4.3-30	0	4.6-5a	2
F 4.3-31	0	4.6-6	2
F 4.3-32	0	4.6-7	0
F 4.3-33	0	4.6-8	2
F 4.3-34	0	4.6-9	2
F 4.3-35	0	4.6-10	2
F 4.3-36	0	4.6-11	2
F 4.3-37	0	4.6-12	2
		4.6-13	2
4.4-1	0	4.6-14	2
4.4-2	0	4.6-15	0
4.4-3	2	4.6-16	2
4.4-4	0	4.6-17	0
4.4-5	0	4.6-18	0
4.4-6	01A	4.6-19	0
4.4-7	0	4.6-20	0
4.4-8	0	4.6-20a	2
4.4-9	0	4.6-21	2
4.4-10	0	4.6-22	0
4.4-11	0	4.6-23	0
4.4-12	0	4.6-24	0
4.4-13	0	4.6-24a	2
4.4-14	0	4.6-25	2
4.4-15	2	4.6-26	2
4.4-16	0	4.6-27	2
4.4-17	2		
		T 4.6-1	0
T 4.4-1	0		
T 4.4-2	0	F 4.6-1	0
		F 4.6-2	0
F 4.4-1	01A	F 4.6-3	0

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CURRENT THROUGH REVISION 2
(Continued)

Page/Table/Figure No.	Revision	Page/Table/Figure No.	Revision
F 4.6-4	BE	5.2-14	2
F 4.6-5	F	5.2-14a	2
F 4.6-6	0	5.2-15	2
F 4.6-7	0	5.2-16	0
F 4.6-8	0	5.2-17	0
F 4.6-9	0	5.2-18	0
F 4.6-10	0	5.2-18a	2
F 4.6-11	0	5.2-19	2a
F 4.6-12	0	5.2-20	2
F 4.6-13	0	5.2-21	2
F 4.6-14	0	5.2-22	2
		5.2-23	0
5i	2	5.2-24	2
5ii	2	5.2-25	0
5iii	2	5.2-26	0
5iv	0	5.2-27	0
5v	0		
5vi	0	T 5.2-1	0
5vii	0	T 5.2-2	2
		T 5.2-3 Sheet 1	0
5.1-1	0	T 5.2-3 Sheet 2	0
5.1-2	2	T 5.2-4	0
		T 5.2-5	0
T 5.1-1 Sheet 1	0	T 5.2-6 Sheet 1	0
T 5.1-1 Sheet 2	2	T 5.2-6 Sheet 2	0
T 5.1-1 Sheet 3	2	T 5.2-6 Sheet 3	0
T 5.1-2	0	T 5.2-7	0
T 5.1-3	2	T 5.2-8	0
F 5.1-1	0	F 5.2-1	0
		F 5.2-2	0
5.2-1	0	F 5.2-3	0
5.2-2	01A	F 5.2-4	0
5.2-2-a	01A	F 5.2-5	0
5.2-3	0	F 5.2-6	0
5.2-4	0	F 5.2-7	0
5.2-5	0	F 5.2-8	0
5.2-6	2	F 5.2-9	CP
5.2-7	2		
5.2-8	0	5.3-1	0
5.2-9	0	5.3-2	0
5.2-10	0	5.3-3	0
5.2-11	0	5.3-4	0
5.2-12	0	5.3-5	0
5.2-13	0	5.3-6	0

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F 5.4-24	AY	6.2-3	0
F 5.4-25	0	6.2-4	01A
F 5.4-26	AD	6.2-5	0
F 5.4-27	U	6.2-6	0
F 5.4-28	0	6.2-7	0
F 5.4-29	0	6.2-8	0
		6.2-9	0
Appendix 5A	0	6.2-10	2
		6.2-11	0
Appendix 5B	0	6.2-12	0
		6.2-13	0
Appendix 5C	0	6.2-14	01A
		6.2-15	2a
6-i	2	6.2-16	2a
6-ii	2	6.2-17	2a
6-iii	0	6.2-18	2a
6-iv	2	6.2-19	2a
6-v	2	6.2-19a	2
6-vi	2	6.2-20	0
6-vii	2	6.2-21	0
6-viii	2	6.2-22	0
6-ix	2	6.2-23	0
		6.2-24	0
6.0-1	0	6.2-24a	2
6.0-2	0	6.2-25	2
6.0-3	0	6.2-26	2
6.0-4	0	6.2-27	2
		6.2-28	2
6.1-1	0	6.2-28a	2
6.1-2	2	6.2-29	0
6.1-3	2	6.2-30	0
6.1-4	2	6.2-31	0
6.1-5	0	6.2-32	0
6.1-6	0	6.2-33	0
6.1-7	0	6.2-34	0
		6.2-35	0
T 6.1-1 Sheet 1	2	6.2-36	0
T 6.1-1 Sheet 2	2	6.2-37	0
T 6.1-1 Sheet 3	2	6.2-38	0
T 6.1-1 Sheet 4	2	6.2-39	0
T 6.1-1 Sheet 5	2	6.2-40	0
T 6.1-1 Sheet 6	2	6.2-41	0
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6.2-45	0	6.2-83	2
6.2-46	0	6.2-84	2
6.2-47	2a	6.2-85	2
6.2-48	2	6.2-85a	2
6.2-49	2	6.2-86	0
6.2-50	2	6.2-87	0
6.2-51	0	6.2-88	2
6.2-52	0	6.2-89	0
6.2-53	0	6.2-90	0
6.2-53a	2	6.2-91	2
6.2-54	2	6.2-92	0
6.2-55	0	6.2-92a	2
6.2-56	0	6.2-93	2
6.2-57	2	6.2-94	2
6.2-58	0	6.2-95	2
6.2-59	2	6.2-95a	2
6.2-60	2	6.2-96	2
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6.2-61	2	6.2-98	2
6.2-62	0	6.2-99	2
6.2-63	2	6.2-100	0
6.2-64	2	6.2-101	0
6.2-65	2a	6.2-102	0
6.2-66	0	6.2-103	0
6.2-67	2	6.2-104	0
6.2-67a	2		
6.2-68	2	T 6.2-1 Sheet 1	0
6.2-69	2	T 6.2-1 Sheet 2	0
6.2-69a	2	T 6.2-1 Sheet 3	0
6.2-70	01A	T 6.2-2 Sheet 1	0
6.2-71	0	T 6.2-2 Sheet 2	0
6.2-72	0	T 6.2-3 Sheet 1	2
6.2-73	0	T 6.2-3 Sheet 2	2
6.2-74	01A	T 6.2-3a Sheet 1	2
6.2-74-a	01A	T 6.2-3b Sheet 1	2
6.2-75	0	T 6.2-4 Sheet 1	0
6.2-75a	2	T 6.2-4 Sheet 2	0
6.2-76	2a	T 6.2-5	0
6.2-77	0	T 6.2-6 Sheet 1	2
6.2-78	2	T 6.2-7 Sheet 1	2
6.2-79	2	T 6.2-7 Sheet 2	0
6.2-80	2	T 6.2-8	0
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T 6.2-9 Sheet 3	2	F 6.2-21	0
T 6.2-9 Sheet 4	2	F 6.2-22	0
T 6.2-9 Sheet 5	2	F 6.2-23	0
T 6.2-9 Sheet 6	2	F 6.2-24	0
T 6.2-9 Sheet 7	2	F 6.2-25	0
T 6.2-9 Sheet 8	2	F 6.2-26	0
T 6.2-9 Sheet 9	2	F 6.2-27	0
T 6.2-9 Sheet 10	2	F 6.2-28	0
T 6.2-9 Sheet 11	2	F 6.2-29	0
T 6.2-9 Sheet 12	2	F 6.2-30	0
T 6.2-9 Sheet 13	2	F 6.2-31	0
T 6.2-9 Sheet 14	2	F 6.2-32	0
T 6.2-9 Sheet 15	2	F 6.2-33	0
T 6.2-10 Sheet 1	2	F 6.2-34	0
T 6.2-10 Sheet 2	2	F 6.2-35	0
T 6.2-10 Sheet 3	2	F 6.2-36	0
T 6.2-11 Sheet 1	2	F 6.2-37	0
T 6.2-11 Sheet 2	2	F 6.2-38	0
T 6.2-11 Sheet 3	2	F 6.2-39	0
T 6.2-12	0	F 6.2-40	0
		F 6.2-41	0
F 6.2-1	0	F 6.2-42	0
F 6.2-2	0	F 6.2-43	0
F 6.2-3	0	F 6.2-44	0
F 6.2-4	0	F 6.2-45	0
F 6.2-5	0	F 6.2-46	0
F 6.2-6	0	F 6.2-47	0
F 6.2-7	0	F 6.2-48	AC
F 6.2-8	0	F 6.2-49	X
F 6.2-9	0	F 6.2-50	AH
F 6.2-10	0	F 6.2-51	AD
F 6.2-11	0	F 6.2-52	0
F 6.2-12	CP	F 6.2-53	0
F 6.2-13	BL	F 6.2-54	0
F 6.2-14	0	F 6.2-55	0
F 6.2-15	0	F 6.2-56	0
F 6.2-16	0	F 6.2-57	0
F 6.2-17	0	F 6.2-58	0
F 6.2-18	0	F 6.2-59	0
F 6.2-19A	2	F 6.2-60	0
F 6.2-19B	2		
F 6.2-20A	2	6.3-1	0
F 6.2-20B	2	6.3-2	0
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6.3-7	2	6.3-49	2
6.3-8	0	6.3-50	0
6.3-9	2	6.3-51	0
6.3-10	2	6.3-52	0
6.3-11	2	6.3-53	0
6.3-11a	2	6.3-54	0
6.3-12	0	6.3-55	2
6.3-13	2	6.3-55a	2
6.3-14	2	6.3-56	2
6.3-15	2	6.3-57	0
6.3-16	2	6.3-58	0
6.3-17	2	6.3-59	0
6.3-18	2	6.3-60	0
6.3-19	2	6.3-61	2
6.3-20	2	6.3-61a	2
6.3-20a	2	6.3-62	2
6.3-21	2	6.3-63	0
6.3-21a	2	6.3-64	0
6.3-22	2	6.3-65	0
6.3-23	0	6.3-66	0
6.3-24	0	6.3-67	0
6.3-25	2	6.3-68	0
6.3-26	2	6.3-69	0
6.3-27	2	6.3-70	0
6.3-28	0	6.3-71	2
6.3-29	0	6.3-72	2
6.3-30	0	6.3-73	2
6.3-31	0	6.3-74	2
6.3-32	0	6.3-75	2
6.3-33	0	6.3-76	2
6.3-34	0	6.3-77	2
6.3-35	0	6.3-78	2
6.3-36	2	6.3-79	2
6.3-37	0	6.3-79a	2
6.3-38	0	6.3-80	0
6.3-39	0	6.3-81	2
6.3-40	0	6.3-82	0
6.3-41	0	6.3-83	2
6.3-42	0	6.3-84	0
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		F 6.3-19	0
T 6.3-1	2	F 6.3-20	0
T 6.3-2	0	F 6.3-21	0
T 6.3-3 Sheet 1	0	F 6.3-22	0
T 6.3-3 Sheet 2	0	F 6.3-23	0
T 6.3-4	2	F 6.3-24	0
T 6.3-5 Sheet 1	0	F 6.3-25	0
T 6.3-5 Sheet 2	0	F 6.3-26	0
T 6.3-6	0	F 6.3-27	0
T 6.3-7 Sheet 1	0	F 6.3-28	0
T 6.3-7 Sheet 2	0	F 6.3-29	0
T 6.3-8	0	F 6.3-30	0
T 6.3-9	0	F 6.3-31	0
T 6.3-10	0	F 6.3-32	0
T 6.3-11	0	F 6.3-33	0
T 6.3-12	2	F 6.3-34	0
T 6.3-13	2	F 6.3-35	0
T 6.3-14	2	F 6.3-36	0
T 6.3-15	2	F 6.3-37	0
T 6.3-16	2	F 6.3-38	0
T 6.3-17	2	F 6.3-39	0
T 6.3-18	2	F 6.3-40	0
T 6.3-19	2	F 6.3-41	0
		F 6.3-42	0
F 6.3-1	0	F 6.3-43	0
F 6.3-2A	YT	F 6.3-44	0
F 6.3-2B	BQ	F 6.3-45	0
F 6.3-3	0	F 6.3-46	0
F 6.3-4	0	F 6.3-47	0
F 6.3-5	0	F 6.3-48	0
F 6.3-6	0	F 6.3-49	0
F 6.3-7A	BQ	F 6.3-50	0
F 6.3-7B	UX	F 6.3-51	0
F 6.3-8	0	F 6.3-52	0
F 6.3-9A	BF	F 6.3-53	0
F 6.3-9B	BP	F 6.3-54	0
F 6.3-10	0	F 6.3-55	0
F 6.3-11	0	F 6.3-56	0
F 6.3-12	0	F 6.3-57	0
F 6.3-13	0	F 6.3-58	0
F 6.3-14	0	F 6.3-59	0
F 6.3-15	0	F 6.3-60	0
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F 6.3-64	0		
F 6.3-65	0	T 6.5-1	01A
F 6.3-66	0		
F 6.3-67	0	F 6.5-1	QG
F 6.3-68	0	F 6.5-2	01A
F 6.3-69	0	F 6.5-3	01A
F 6.3-70	0		
F 6.3-71	0	6.6-1	0
F 6.3-72	0	6.6-2	0
F 6.3-73	0	6.6-3	0
F 6.3-74	0		
F 6.3-75	0	7i	0
F 6.3-76	0	7ii	2
F 6.3-77	2	7iii	2
F 6.3-78	2	7iv	0
F 6.3-79	0	7v	0
F 6.3-80	2	7vi	2
F 6.3-81	0	7vii	0
F 6.3-82	0		
F 6.3-83	2	7.1-1	0
F 6.3-84	2	7.1-2	0
		7.1-3	0
6.4-1	0	7.1-4	0
6.4-2	2		
6.4-3	2	7.2-1	0
6.4-4	01A	7.2-2	0
6.4-5	01A	7.2-3	0
6.4-6	2	7.2-4	0
6.4-7	0	7.2-5	0
6.4-8	0	7.2-6	0
6.4-9	0	7.2-7	0
6.4-10	2	7.2-7a	2
6.4-11	0	7.2-8	2
		7.2-9	2
T 6.4-1	0	7.2-9a	2
		7.2-10	2
F 6.4-1	0	7.2-11	0
F 6.4-2	0	7.2-12	0
F 6.4-3	0	7.2-13	0
		7.2-14	0
6.5-1	2	7.2-15	0
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7.2-20	0	7.3-30	0
7.2-21	0	7.3-31	0
7.2-22	0	7.3-32	2
7.2-23	0	7.3-33	0
7.2-24	0	7.3-33a	2
7.2-25	0	7.3-34	2
7.2-26	0	7.3-35	0
7.2-27	0	7.3-36	0
		7.3-37	0
T 7.2-1	2	7.3-38	2
		7.3-39	0
F 7.2-1	0	7.3-40	2
F 7.2-2	0	7.3-41	2
F 7.2-3	0	7.3-42	0
F 7.2-4	0	7.3-43	2
		7.3-44	2
7.3-1	0	7.3-45	0
7.3-2	2	7.3-46	0
7.3-3	0	7.3-47	2
7.3-4	2	7.3-48	0
7.3-5	2	7.3-48a	2
7.3-6	2	7.3-49	2
7.3-7	2	7.3-50	0
7.3-8	0		
7.3-9	2	T 7.3-1	2
7.3-10	2		
7.3-11	0	F 7.3-1	2
7.3-12	0	F 7.3-2A	2
7.3-13	0	F 7.3-2B	0
7.3-14	0	F 7.3-3	0
7.3-15	0	F 7.3-4	0
7.3-16	2	F 7.3-5	0
7.3-17	2	F 7.3-6	0
7.3-18	2	F 7.3-7	0
7.3-19	2	F 7.3-8A	2
7.3-20	2	F 7.3-8B	0
7.3-21	0	F 7.3-8C	0
7.3-22	2	F 7.3-9	2
7.3-23	0	F 7.3-10	2
7.3-24	0	F 7.3-11	0
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7.5-2	0	F 7.6-4	0
7.5-3	0	F 7.6-5	0
7.5-4	2	F 7.6-6	0
7.5-5	0	F 7.6-7	0
7.5-6	2	F 7.6-8	0
7.5-7	0	F 7.6-9	0
7.5-8	0	F 7.6-10	0
7.5-9	0	F 7.6-11	0
7.5-10	0	F 7.6-12	0
7.5-11	0	F 7.6-13	0
7.5-12	0	F 7.6-14	0
		F 7.6-15	0
F 7.5-1	0	F 7.6-16	0
		F 7.6-17	2
7.6-1	0		
7.6-2	0	7.7-1	0
7.6-3	0	7.7-2	0
7.6-4	2	7.7-3	0
7.6-5	0	7.7-4	0
7.6-6	0	7.7-5	0
7.6-7	0	7.7-6	0
7.6-8	0	7.7-7	0
7.6-9	0	7.7-7a	2
7.6-10	0	7.7-8	2
7.6-11	0	7.7-9	0
7.6-12	0	7.7-10	0
7.6-13	2	7.7-11	2
7.6-14	0	7.7-12	0
7.6-15	2	7.7-13	0
7.6-16	0	7.7-14	0
7.6-17	0	7.7-15	0
7.6-18	0	7.7-16	0
7.6-18a	2	7.7-17	0
7.6-19	2	7.7-18	0
7.6-20	01A	7.7-19	2
7.6-21	2	7.7-19a	2
7.6-22	2	7.7-20	2
7.6-22a	2	7.7-21	0
7.6-23	0	7.7-22	0
7.6-24	2	7.7-23	0
7.6-24a	2	7.7-24	0
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7.7-29	0	8.2-4	0
7.7-30	0	8.2-5	0
7.7-31	0	8.2-6	0
7.7-31a	2	8.2-7	0
7.7-32	2		
7.7-33	2	T 8.2-1	0
7.7-34	2		
7.7-34a	2	F 8.2-1	2
7.7-35	2	F 8.2-2	0
7.7-36	2	F 8.2-3	C
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		F 8.2-5A	0
T 7.7-1	0	F 8.2-5B	0
T 7.7-2	0	F 8.2-6	0
		F 8.2-7A	0
F 7.7-1	0	F 8.2-7B	0
F 7.7-2	0	F 8.2-8	0
F 7.7-3	0	F 8.2-9A	0
F 7.7-4	0	F 8.2-9B	0
F 7.7-5	0		
F 7.7-6	0	8.3-1	0
F 7.7-7	0	8.3-2	0
F 7.7-8	0	8.3-3	0
F 7.7-9	0	8.3-4	01A
		8.3-5	01A
7.8-1	0	8.3-6	0
7.8-2	2	8.3-7	0
7.8-3	2	8.3-8	01A
7.8-4	0	8.3-9	2
7.8-5	0	8.3-10	0
7.8-6	0	8.3-11	0
		8.3-12	0
F 7.8-1	0	8.3-13	0
		8.3-14	0
8-i	2	8.3-15	0
8-ii	0	8.3-16	0
8-iii	0	8.3-17	0
		8.3-18	2
8.1-1	0	8.3-18a	2
8.1-2	2	8.3-19	2
		8.3-20	2
8.2-1	0	8.3-20a	2

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8.3-21-a	01A		
8.3-22	2	9.1-1	2
8.3-23	2	9.1-2	2
8.3-24	2	9.1-2a	2
8.3-24a	2	9.1-3	01A
8.3-25	2	9.1-4	2
8.3-25a	2	9.1-5	01A
8.3-26	2a	9.1-5a	01A
8.3-27	01A	9.1-6	0
		9.1-7	2
T 8.3-1 Sheet 1	2	9.1-7a	2
T 8.3-1 Sheet 2	2	9.1-8	0
T 8.3-1 Sheet 3	2	9.1-9	2
T 8.3-1 Sheet 4	2	9.1-9a	2
T 8.3-1 Sheet 5	2	9.1-10	2
T 8.3-1 Sheet 6	2	9.1-11	2
T 8.3-1 Sheet 7	2	9.1-11a	2
T 8.3-2	0	9.1-12	2
T 8.3-3	0	9.1-13	2
T 8.3-4	0	9.1-13a	2
T 8.3-5	0	9.1-14	2
T 8.3-6	0	9.1-15	2
T 8.3-7	2	9.1-16	2
T 8.3-8	01A	9.1-17	2
		9.1-18	2
F 8.3-1	L	9.1-19	2
F 8.3-2	AH	9.1-20	2
F 8.3-3	0	9.1-21	2
F 8.3-4	0	9.1-22	2
F 8.3-5	0	9.1-23	2
F 8.3-6	0	9.1-24	0
F 8.3-7	0	9.1-25	2
F 8.3-8	0	9.1-26	2
F 8.3-9	D		
F 8.3-10	C	T 9.1-1	2
F 8.3-11	R	T 9.1-2	2
		T 9.1-3 Sheet 1	0
9-i	2	T 9.1-3 Sheet 2	0
9-ii	2	T 9.1-3 Sheet 3	0
9-iii	2	T 9.1-3 Sheet 4	0
9-iv	2	T 9.1-4 Sheet 1	2
9-v	2	T 9.1-4 Sheet 2	2
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F 9.1-2	0	9.2-21	2
F 9.1-3	BD	9.2-21a	2
F 9.1-4	AN	9.2-22	2
F 9.1-5	0	9.2-23	0
F 9.1-6	0	9.2-24	0
F 9.1-7	0		
F 9.1-8	2	T 9.2-1	2
F 9.1-9	0	T 9.2-2 Sheet 1	0
F 9.1-10	0	T 9.2-2 Sheet 2	0
F 9.1-11	2	T 9.2-3	0
F 9.1-12	2	T 9.2-4	0
F 9.1-13	AF		
F 9.1-14	Y	F 9.2-1	AC
F 9.1-16	0	F 9.2-2	AA
F 9.1-17	0	F 9.2-3	CG
F 9.1-18	0	F 9.2-4	PJ
F 9.1-19	0	F 9.2-5	0
F 9.1-20	0	F 9.2-6	0
		F 9.2-7	0
9.2-1	0	F 9.2-8	KX
9.2-2	2	F 9.2-9	AK
9.2-3	0	F 9.2-10	CR
9.2-3a	2	F 9.2-11	C
9.2-4	2	F 9.2-12	C
9.2-5	0	F 9.2-13	A
9.2-6	0	F 9.2-14	A
9.2-7	0	F 9.2-15	C
9.2-7a	2	F 9.2-16	B
9.2-8	2	F 9.2-17	A
9.2-9	0	F 9.2-18	A
9.2-10	0	F 9.2-19	AT
9.2-11	0	F 9.2-20	MA
9.2-11a	2	F 9.2-21	AF
9.2-12	2	F 9.2-22	AM
9.2-12a	2		
9.2-13	2	9.3-1	01A
9.2-14	0	9.3-2	2a
9.2-15	2	9.3-3	2a
9.2-16	2	9.3-4	01A
9.2-16a	2	9.3-4-a	01A
9.2-17	2	9.3-5	01A
9.2-18	2	9.3-5a	2
9.2-19	2	9.3-6	2
9.2-19a	2	9.3-7	01A
9.2-20	2	9.3-8	01A

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9.3-11	01A	9.4-3	0
9.3-12	01A	9.4-4	2
9.3-13	01A	9.4-5	0
9.3-14	01A	9.4-6	01A
9.3-15	01A	9.4-7	2
9.3-16	01A	9.4-8	2
9.3-17	01A	9.4-9	2
9.3-18	01A	9.4-9a	2
9.3-19	01A	9.4-10	0
9.3-20	01A	9.4-11	0
9.3-21	01A		
9.3-22	2	F 9.4-1	E
9.3-23	01A	F 9.4-2	F
9.3-24	01A	F 9.4-3	13
9.3-25	01A	F 9.4-4	AD
9.3-26	01A	F 9.4-5	L
9.3-27	01A	F 9.4-6	B
9.3-28	2	F 9.4-7	F
9.3-28a	2	F 9.4-8	F
9.3-29	2	F 9.4-9	P
9.3-30	2	F 9.4-10A	B
9.3-31	01A	F 9.4-10B	A
9.3-32	01A	F 9.4-11	H
9.3-33	2	F 9.4-12	F
9.3-34	01A	F 9.4-13	E
9.3-35	01A	F 9.4-14	E
9.3-36	01A	F 9.4-15	Q
		F 9.4-16	Q
T 9.3-1	0	F 9.4-17	F
T 9.3-2 Sheet 1	0	F 9.4-18	C
T 9.3-2 Sheet 2	0	F 9.4-19	A
T 9.3-2 Sheet 3	0		
T 9.3-3	2	9.5-1	01A
		9.5-2	0
F 9.3-1	E	9.5-3	2
F 9.3-2	E	9.5-3-a	01A
F 9.3-3	AV	9.5-4	01A
F 9.3-4	J	9.5-5	0
F 9.3-5	01A	9.5-6	2
F 9.3-6	0	9.5-7	2
F 9.3-7	0	9.5-8	01A
F 9.3-8	HS	9.5-9	2a
F 9.3-9	0	9.5-10	0

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9.5-14	2	10.3-2	2
9.5-15	2	10.3-3	0
9.5-16	2		
9.5-17	2	T 10.3-1	2
9.5-18	2		
9.5-19	2	F 10.3-1	NW
9.5-20	2	F 10.3-2	AAP
9.5-21	2	F 10.3-3	AP
		F 10.3-4	PD
T 9.5-1	0		
T 9.5-2	0	10.4-1	0
		10.4-2	0
F 9.5-1	X	10.4-3	2
F 9.5-2	0	10.4-4	2
F 9.5-3	0	10.4-5	2
F 9.5-4	0	10.4-6	2
F 9.5-5	0	10.4-7	2
F 9.5-6	F	10.4-8	2
F 9.5-7	F	10.4-9	0
F 9.5-8	E	10.4-10	0
F 9.5-9	0	10.4-11	2
F 9.5-10	AN	10.4-11a	2
F 9.5-11	G	10.4-12	0
F 9.5-12	G	10.4-13	2
F 9.5-13	F	10.4-14	2
F 9.5-14	2	10.4-15	2
		10.4-16	2
10-i	2	10.4-17	2
10-ii	0	10.4-18	2
10-iii	0	10.4-19	0
10-iv	2		
		T 10.4-1 Sheet 1	0
10.1-1	0	T 10.4-1 Sheet 2	2
		T 10.4-2	2
T 10.1-1	0	T 10.4-3	2
		T 10.4-4	0
10.2-1	2	T 10.4-5	0
10.2-2	2		
10.2-3	0	F 10.4-1	KC
10.2-4	0	F 10.4-2	0
10.2-5	2	F 10.4-3	PW
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F 10.4-5	VB	11.2-11	0
F 10.4-6	XA	11.2-12	2
F 10.4-7	AE	11.2-13	0
F 10.4-8	LB	11.2-14	0
F 10.4-9	AZ	11.2-15	2
F 10.4-10	AB	11.2-16	0
F 10.4-11	AD	11.2-17	2
F 10.4-12	S	11.2-18	2
F 10.4-13	2	11.2-19	2
		11.2-20	2
11-i	0	11.2-21	0
11-ii	0	11.2-22	0
11-iii	0		
11-iv	0	T 11.2-1	0
11-v	0	T 11.2-2	0
11-vi	0	T 11.2-3	0
		T 11.2-4 Sheet 1	0
11.1-1	0	T 11.2-4 Sheet 2	0
11.1-2	2	T 11.2-5	0
11.1-2a	2	T 11.2-6	0
11.1-3	01A	T 11.2-7 Sheet 1	0
11.1-4	0	T 11.2-7 Sheet 2	0
11.1-5	0	T 11.2-8	0
11.1-6	0	T 11.2-9	0
11.1-7	0		
11.1-8	0	F 11.2-1	CH
11.1-9	0	F 11.2-2	VE
11.1-10	01A	F 11.2-3	YN
11.1-11	0	F 11.2-4	MZ
		F 11.2-5	AC
T 11.1-1	0	F 11.2-6	N
T 11.1-2	0	F 11.2-7	AA
T 11.1-3 Sheet 1	2	F 11.2-8	AA
T 11.1-3 Sheet 2	2	F 11.2-9	R
		F 11.2-10	AP
11.2-1	0	F 11.2-11	AF
11.2-2	2	F 11.2-12	X
11.2-3	2	F 11.2-13	X
11.2-4	2	F 11.2-14	X
11.2-5	2	F 11.2-15	K
11.2-6	2	F 11.2-16	E
11.2-7	2	F 11.2-17	A
11.2-8	2	F 11.2-18	E
11.2-9	2	F 11.2-19	K
11.2-10	2	F 11.2-20	K

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11.3-2	2	F 11.3-16	G
11.3-3	2	F 11.3-17	2
11.3-4	2	F 11.3-18	D
11.3-5	2	F 11.3-19	N
11.3-6	2		
11.3-6a	2	11.4-1	2
11.3-7	2	11.4-2	0
11.3-8	2	11.4-3	2
11.3-9	2	11.4-4	2
11.3-10	2	11.4-5	0
11.3-11	2	11.4-6	2
11.3-12	2	11.4-7	0
11.3-13	2	11.4-8	0
11.3-14	2		
11.3-15	0	T 11.4-1	0
11.3-16	2	T 11.4-2	0
11.3-17	0		
11.3-18	0	F 11.4-1	AN
		F 11.4-2	0
T 11.3-1	0	F 11.4-3	2
T 11.3-2	2		
T 11.3-3	0	11.5-1	0
T 11.3-4	2	11.5-2	0
T 11.3-5	2	11.5-3	0
T 11.3-6 Sheet 1	0	11.5-4	0
T 11.3-6 Sheet 2	0	11.5-5	0
T 11.3-7	0	11.5-6	0
T 11.3-8 Sheet 1	0	11.5-7	0
T 11.3-8 Sheet 2	0	11.5-8	2
		11.5-9	01A
F 11.3-1	BP	11.5-10	01A
F 11.3-2	AA	11.5-11	0
F 11.3-3	AC	11.5-12	0
F 11.3-4	HS	11.5-13	2
F 11.3-5	AB	11.5-14	01A
F 11.3-6	Y	11.5-14-a	01A
F 11.3-7	AAP	11.5-15	0
F 11.3-8	PD	11.5-16	2
F 11.3-9	2	11.5-17	0
F 11.3-10	0	11.5-18	2
F 11.3-11	7	11.5-19	0
F 11.3-12	7	11.5-20	0

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13.2-7	0	14.2-3	0
13.2-8	0	14.2-4	0
13.2-9	0	14.2-5	0
13.2-10	0	14.2-6	0
13.2-11	0	14.2-7	0
		14.2-8	0
T 13.2-1	0	14.2-9	0
		14.2-10	0
13.3-1	01A	14.2-11	0
		14.2-12	0
13.4-1	2	14.2-13	0
		14.2-14	0
13.5-1	2	14.2-15	0
13.5-2	2	14.2-16	0
13.5-2a	2	14.2-17	0
13.5-3	2	14.2-18	0
13.5-4	2a	14.2-19	0
13.5-5	2	14.2-20	0
13.5-6	2	14.2-21	0
13.5-7	2a	14.2-22	0
13.5-7a	2	14.2-23	0
13.5-8	2	14.2-24	0
13.5-9	2a	14.2-25	0
13.5-10	2a	14.2-26	0
		14.2-27	0
T 13.5-1 Sheet 1	0	14.2-28	0
T 13.5-1 Sheet 2	0	14.2-29	0
		14.2-30	0
13.6-1	2	14.2-31	0
13.6-2	2	14.2-32	0
		14.2-33	0
13.7-1	2	14.2-34	0
13.7-2	0	14.2-35	0
		14.2-36	0
T 13.7-1 Sheet 1	2	14.2-37	0
T 13.7-1 Sheet 2	2	14.2-38	0
		14.2-39	0
14-i	0	14.2-40	0
14-ii	0	14.2-41	0
14-iii	0	14.2-42	0
		14.2-43	0
14.1-1	0	14.2-44	0
		14.2-45	0
14.2-1	0	14.2-46	0

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14.2-49	0	15.1-5	0
14.2-50	0	15.1-6	2
14.2-51	0	15.1-7	0
14.2-52	0	15.1-8	0
14.2-53	0		
14.2-54	0	F 15.1-1	0
14.2-55	0	F 15.1-2	0
14.2-56	0	F 15.1-3	0
14.2-57	0	F 15.1-4	0
14.2-58	0	F 15.1-5	0
14.2-59	0	F 15.1-6	0
14.2-60	0	F 15.1-7	0
14.2-61	0	F 15.1-8	0
14.2-62	0		
14.2-63	0	15.2-1	0
14.2-64	0	15.2-2	0
14.2-65	0	15.2-3	0
		15.2-4	2
T 14.2-1 Sheet 1	0	15.2-5	2
T 14.2-1 Sheet 2	0	15.2-6	0
T 14.2-2	0	15.2-7	0
T 14.2-3	0	15.2-8	2
T 14.2-4	0	15.2-8a	2
		15.2-8b	2
F 14.2-1	0	15.2-9	2
F 14.2-2	0	15.2-10	01A
		15.2-11	2
15-i	0	15.2-12	2
15-ii	0		
15-iii	0	F 15.2-1	0
15-iv	0	F 15.2-2	0
15-v	0	F 15.2-3	0
15-vi	0	F 15.2-4	0
15-vii	0	F 15.2-5	0
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		F 15.2-7	0
15.0-1	2	F 15.2-8	0
15.0-2	0	F 15.2-9	0
15.0-3	2	F 15.2-10	0
15.0-4	2		
		15.3-1	0
15.1-1	0	15.3-2	0
15.1-2	0	15.3-3	0

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15.3-5	0	15.6-4	2
15.3-6	0	15.6-5	0
15.3-7	0	15.6-6	0
15.3-8	0	15.6-7	0
		15.6-8	0
F 15.3-1	0	15.6-9	0
F 15.3-2	0	15.6-10	0
F 15.3-3	0	15.6-11	0
F 15.3-4	0	15.6-12	0
F 15.3-5	0	15.6-13	2
F 15.3-6	0	15.6-14	0
F 15.3-7	0	15.6-15	0
F 15.3-8	0	15.6-16	2
F 15.3-9	0	15.6-17	2
		15.6-18	2
15.4-1	2	15.6-19	0
15.4-2	0	15.6-20	2a
15.4-3	2	15.6-21	0
15.4-4	2	15.6-22	0
15.4-5	0	15.6-23	0
15.4-6	0	15.6-24	0
15.4-7	0		
15.4-8	0	T 15.6-1	0
15.4-9	0	T 15.6-2	0
15.4-10	0	T 15.6-3	0
15.4-11	0	T 15.6-4	0
15.4-12	0	T 15.6-5	0
15.4-13	0	T 15.6-6	2
15.4-14	01A	T 15.6-7	2
15.4-15	0	T 15.6-8 Sheet 1	0
15.4-16	0	T 15.6-8 Sheet 2	0
		T 15.6-9 Sheet 1	2
T 15.4-1	0	T 15.6-9 Sheet 2	2
T 15.4-2	0	T 15.6-10	2
T 15.4-3	0		
		F 15.6-1	0
F 15.4-1	0	F 15.6-2	0
F 15.4-2	0	F 15.6-3	0
		F 15.6-4	0
15.5-1	0		
15.5-2	0	15.7-1	0
		15.7-2	0
15.6-1	0	15.7-3	0
15.6-2	0	15.7-4	2

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15.7-7	0		
15.7-8	0	16-i	0
15.7-9	0		
15.7-10	2	16.0-1	0
15.7-11	0	16.0-2	0
15.7-12	0		
15.7-13	0	17-i	0
15.7-14	0		
15.7-15	0	17.1-1	0
15.7-16	0		
15.7-17	0	17.2-1	0
15.7-18	0	17.2-2	0
15.7-19	2		
15.7-20	0		
T 15.7-1 Sheet 1	0		
T 15.7-1 Sheet 2	0		
T 15.7-1 Sheet 3	0		
T 15.7-1 Sheet 4	0		
T 15.7-1 Sheet 5	0		
T 15.7-1 Sheet 6	0		
T 15.7-1 Sheet 7	0		
T 15.7-1 Sheet 8	0		
T 15.7-2	2		
T 15.7-3	0		
T 15.7-4	0		
T 15.7-5	0		
15.8-1	0		
15.8-2	0		
15.8-3	0		
15.8-4	0		
15.8-5	0		
15.8-6	0		
15.8-7	0		
15.8-8	0		
15.8-9	0		
15.8-10	0		
15.8-11	0		
F 15.8-1	0		
F 15.8-2	0		
F 15.8-3	0		

Revision History

Revision	Date
1a	December, 1995
2	June, 1997
2a	November, 1997

Table 3.8-1

DRYWELL MAJOR PENETRATION CLASSIFICATION
UNIT 2

Penetration	Quantity	Service	Type[1]	Size (in.)
X-105A, B, C, D	4	Main steam	1	20
X-106	1	Main steam drain	1	2
X-107A, B	2	Feedwater	1	18
X-108A	1	Isolation condenser steam supply	1	14
X-109B	1	Isolation condenser return	1	12
X-111A, B	2	Shutdown cooling supply	1	8
X-113	1	Cleanup system supply	1A	8
X-115	1	HPCI steam supply	1	10
X-116A	1	LPCI pump discharge	1B	16
X-116B	1	LPCI pump discharge	1	16
X-117	1	Drywell floor drain sump discharge	2	3
X-118	1	Drywell equipment drain sump discharge	2	3
X-119	1	Demineralized water supply	2	3
X-120	1	Service air supply	2	1
X-121	1	Instrument air supply	2	1
X-123	1	Reactor building closed cooling water supply	1	6
X-124	1	Reactor building closed cooling water return	1	6
X-130	1	Standby liquid control	1	1½
X-144[2]	1	CRD system return[2]	1[2]	4
X-145, X-150	2	Containment spray	2	10
X-147	1	Reactor head cooling	1	2½
X-149A, B	2	Core spray	1A	10

Notes:

1. Penetration types are illustrated in Figures 3.8-8 (Type 1), 3.8-9 A (Type 1A), 3.8-9B (Type 1B), and 3.8-10 (Type 2).
2. The Unit 2 CRD return line was removed inside the drywell in 1993. The penetration and the CRD return line were both capped on the inboard side of the penetration.

Based on analyses of the reactor internals during both normal and accident conditions, it was determined that stresses in the individual components are limiting, except in the following areas where deformation is the controlling parameter:

A. Deflection of the fuel channels under accident pressure conditions is limited to an amount substantially less than that which would prevent control rod drive insertion. The maximum frictional force exerted on the fuel channel by the control rod (as a result of interference), during a design basis accident, is less than 100 pounds. The minimum force exerted by the control rod drive on a control blade is 3000 pounds. Therefore, control blades can be fully inserted against the forces of fuel channel deflection under the most severe accident conditions. Under the above control rod insert conditions, the fuel bundles which weigh about 700 pounds will not be lifted due to the resisting insertion forces of 100 pounds friction from the deflection of its members.

B. Horizontal deflection of the control rod drive housings is limited to a value which through test has been demonstrated not to impede control rod insertion.

C. Deflection of the core plate and lower grid assembly is limited under normal operation to preclude taking up vertical clearance between the core plate and control rod guide tubes so that the core bypass leakage flow can be predicted. This results in stresses that are below yield even during accident conditions. The maximum deflection of the core plate under accident conditions is limited to 0.125 inches, which represents a considerable factor of safety below the deflection at which the core plate and guide tube could come into contact.

The maximum value of primary stress in reactor internal components generally results from the large pressure difference created when either the recirculation line or the steam line are completely severed. A discussion of these two accidents is given in Sections 3.9.5.3.1.2 and 3.9.5.3.1.3, respectively.

The sensitive point within the reactor pressure vessel which is most affected by operation of the emergency core cooling systems (HPCI and LPCI) is in the area of the jet pump to baffle plate joint. The stress and fatigue evaluation of this location is discussed in Section 3.9.5.3.2.

Table 3.11-3

RELATIVE HUMIDITY BY ENVIRONMENTAL ZONE

Zone	Relative Humidity (%)		
	Normal	Spurious	Accident
1	20—90	5—100	100(C)
2(2)	20—90	5—100	100(C)
3	20—90	5—100	100(C)
4	20—90	5—100	100(C)
5	20—90	5—100	100(C)
6	20—90	5—100	100(C)
7(1)	20—90	5—100	100(NC)
7a(1)	20—90	5—100	100(NC)
7b(1)	20—90	5—100	100(NC)
8	20—90	5—100	100(C)
9	20—90	5—100	100(C)
9a	20—90	5—100	100(C)
10(2)	20—90	5—100	100(C)
11(2)	20—90	5—100	100(C)
12(2)	20—90	5—100	100(C)
13(2)	20—90	5—100	100(C)
14(2)	20—90	5—100	100(C)
15(2)	20—90	5—100	100(C)
16(2)	20—90	5—100	100(C)
17(1)	20—90	5—100	100(NC)
18(1)	20—90	5—100	100(NC)
19(1)	20—90	5—100	100(NC)
19a	40—70	20—90	90
20(1)	20—90	5—100	100(NC)
20a(1)	20—90	5—100	100(NC)
21	20—90	5—100	100(C)

Table 3.11-3 (Continued)

RELATIVE HUMIDITY BY ENVIRONMENTAL ZONE

	Relative Humidity (%)		
Zone	Normal	Spurious	Accident
22	20—90	5—100	100(C)
23	20—90	5—100	100(C)
24[1]	20—90	5—100	100(NC)
25	20—90	5—100	100(C)
26[1]	20—90	5—100	100(NC)
27[1]	20—90	5—100	100(NC)
28	20—90	5—100	100(C)
29	20—90	5—100	100(C)
30[1]	20—90	5—100	100(NC)
30a	40—70	20—90	90
31	20—90	5—100	100(C)
31a[1]	20—90	5—100	100(NC)
32	20—90	5—100	100(C)
33	20—90	5—100	100(C)
34[1]	20—90	5—100	100(NC)
35[1]	20—90	5—100	100(NC)
36[1]	20—90	5—100	100(NC)
37[1]	20—90	5—100	100(NC)
38[1]	20—90	5—100	100(NC)
39[1]	20—90	5—100	100(NC)
40[1]	20—90	5—100	100(NC)
41	20—90	5—100	100(C)
42	20—90	5—100	100(C)

Table 3.11-3 (Continued)

RELATIVE HUMIDITY BY ENVIRONMENTAL ZONE

Zone	Relative Humidity (%) Normal	Spurious	Accident
43(1)	20—90	5—100	100(NC)
44(1)	20—90	5—100	100(NC)
45(1)	20—90	5—100	100(NC)
46(1)	20—90	5—100	100(NC)
47	20—90	5—100	100(C)

Notes:

(C) = Condensing (NC) = Noncondensing

1. Maximum relative humidity for individual components containing an equipment heat source is 95%. Maximum relative humidity for area without a moisture source is 95%.

2. Maximum relative humidity for motor control centers and bus ducts in this zone is 95%.

5.2.5 Detection of Leakage Through Reactor Coolant Pressure Boundary

In the operation of any power plant, fossil fuel or nuclear, the ability to detect leaks and mitigate possible serious incidents is necessary for safe power plant operation. For a nuclear fuel plant, the detection and location of leakage is important due to the possible consequences to the public. However, there is a major difference between the "detection" of a leak and the "location" of a leak. The ability to detect a very small leak, e.g., in the cubic centimeters per minute range, is of no value unless the source of leakage can be found.

Ideally, frequent visual inspection by operating personnel of the main steam and feedwater lines would provide the means for detection of small leaks. Due to the steam lines being high sources of radiation and the proximity of the feedwater lines to the steam lines, visual inspection is possible only at low reactor power for those lines outside the drywell and with the reactor subcritical for those lines inside the drywell.

With the use of an unmanned containment for both units, remote means of leak location must be employed. However, at some point in the sequence of locating a leak, the visual inspection is necessary. For this visual inspection to be meaningful, the primary system has to be at or near operating conditions of pressure and temperature.

Once a leak has been determined to exist in the primary system within the primary containment, the magnitude of the leakage has to be determined.

If the leakage is within the allowable limit set by Technical Specifications, unit operation can continue unless the leakage is determined to be due to a through-wall RCPB pipe crack.

Since the primary containments for both units are unmanned systems, it is necessary that the operator be provided with remote means for the detection of leakage from the primary system. A number of systems are provided for the purpose of leak detection. Through the use of instrumentation on other operating systems and the systems to be discussed below, it is possible to determine the source and magnitude of the leakage.

The description of the systems contained in this section would be used by the operator to determine that leakage does exist within the drywell. These various systems operating together or singly provide information to the operator that a possible problem has developed within the drywell.

are placed below normal water level, near the normal center of gravity of the water mass and horizontally equidistant. The individual sensors for each channel are continuously recorded in the control room.

The original containment pressure and suppression pool water level instruments have been modified to meet the requirements of NUREG-0578, Section 2.1.9 to provide a wider range of indications. Both instruments provide indication in the control room. Water level indication is from the bottom to near the top of the suppression pool. This indication allows determination of suppression pool water inventory during emergency conditions. The pressure instrument displays pressures from -5 psig to four times containment design pressure (62.5 psig) or 250 psig.

The drywell temperature monitoring system monitors drywell temperature at predetermined locations and records the temperatures so that the temperature effects on environmentally qualified (EQ) equipment located in the drywell can be determined.

As a result of the Unit 2 drywell high temperature event,[6] the location of the Unit 3 drywell thermocouples in relation to the EQ equipment was evaluated. The analysis revealed that only 12 of the 28 drywell thermocouples monitored EQ equipment. As a result, existing thermocouples which previously monitored areas with non-EQ equipment were relocated to areas near EQ equipment.

Similarly, various Unit 2 drywell thermocouples were relocated to provide more meaningful temperature indications.

To meet Regulatory Guide 1.97 requirements, eight drywell atmosphere thermocouples have been environmentally qualified. Refer to Section 3.11 for a description of the EQ Program and to Section 7.5 for a description of the R.G. 1.97 Program.

6.2.1.3 Design Evaluation

6.2.1.3.1 Sizing of the Primary Containment

The design parameters for the primary containment system are based on data obtained from the Bodega Bay tests, conducted for Pacific Gas and Electric Company (PG&E) at the Moss Landing steam plant in 1962.[1] By juxtaposition of the Unit 2 and 3 data with the Bodega Bay data, the following design values were determined.

A. The drywell and suppression chamber and connecting vent system tubes are designed for 62 psig internal pressure at 281°F. The application of the Bodega Bay pressure suppression test data to the Dresden primary containments established a drywell pressure of 62 psig (including a 10 psi margin) and a suppression chamber pressure of 35 psig (including a 5 psi margin) as design requirements. To simplify pressure tests of the primary containment, the suppression chamber design pressure was set equal to that of the drywell, at 62 psig. The drywell and connecting vents are designed for an external-to-internal pressure differential of 2 psi at 281°F, and the suppression chamber is designed for an external-to-internal pressure differential of 1 psi at 281°F.

B. The drywell is designed to withstand a local hot spot temperature of 300°F with a surrounding shell temperature of 150°F, concurrent with the design pressure of 62 psig.

C. The minimum total vent line cross-sectional area is the total design accident break flow area, divided by 0.0194. The entrance area around the jet deflection baffles from the drywell to the vent lines is a minimum of 1.4 times the vent line area to minimize entrance losses.

D. The ASME Code impact test requirements for materials used for pressure-containing parts of the primary containment vessel call for the establishment of the lowest metal temperature that will be experienced while the unit is in operation. The lowest temperature to which the primary containment vessel pressure-containing parts could actually be subjected while the unit is in operation is 50°F, because the primary containment system is housed in a building which is maintained at or above this minimum temperature during reactor operation, and the containment vessel pressure-containing parts would be maintained at or above this temperature while subjected to post-accident design loadings. To provide an additional factor of safety, the design basis minimum service metal temperature was established as 30°F.

The size of the reactor vessel and associated auxiliary equipment dictated the required drywell dimensions. The lower part of the drywell is a sphere with an inside diameter of 66 feet; the upper part of the drywell is a cylinder 46 feet high with an inside diameter of 37 feet.

The volume of the drywell vessel, including connected vent lines is:

Gross Volume	198,440 ft^3
Occupied Space	40,204 ft^3
Net Free Volume	158,236 ft^3

The total volume of the coolant in the reactor process system, which could be discharged into the drywell and carried over into the suppression chamber during an accident, was calculated to be 10,030 cubic feet. This calculation considered the reactor coolant system, the recirculation system, the main steam system, the feedwater system, the cleanup system, the isolation condenser system, and the shutdown cooling system.

The amount of water required to absorb the reactor system sensible heat was based upon a 50°F rise in the suppression chamber water temperature, 10 seconds of full power operation, and a temperature reduction from 550°F to 281°F for the reactor vessel and internals, reactor coolant, recirculation water, main steam system, feedwater system, cleanup system, shutdown cooling system, and isolation condenser system. The minimum water volume required to meet these criterion was calculated to be 112,200 cubic feet.

The size of the suppression chamber was calculated using the gas law equation, performing a ratio for initial and final conditions and solving for V_2:

$$V_2 = \frac{P_1 V_1 T_2}{P_2 T_1}$$

where:

$V_2 = V_{aw}$ (gas volume of suppression chamber) - 10,030 ft^3 (carryover volume)

$V_1 = V_D$ (volume of drywell) + V_{aw}.

$P_1 = 14.7 + 0.5 - 0.8$ (vapor pressure of water at T_1) = 14.4 psia

$P_2 = 29.0 + 14.7 - 3.3$ (vapor pressure of water at T_2) = 40.4 psia

T_1 = 555°R (95°F) (operational temperature limit)

T_2 = 605°R (145°F)

From this it was determined that:

V_{aw} = 117,000 ft^3

This value represents the free volume required in the gas space of the suppression chamber to limit the suppression chamber pressure to 29 psig at 145°F assuming an initial pressure of 0.5 psig at 95°. This volume was used to calculate the required suppression chamber dimensions as described below.

The design suppression chamber water volume was determined to be 115,600 ft^3. This provides the minimum volume required for heat absorption, 112,200 ft^3, plus 3,400 ft^3 for level control.

The structural material volume, which includes structural members within the suppression chamber and the contained volume of vent piping, was determined to be 14,400 ft^3. Combining these volumes yielded:

Gross Volume of Suppression Chamber = 247,000 ft^3

From this calculated value for the gross volume of the suppression chamber, the suppression chamber dimensions of 109-foot major diameter with 30-foot minor diameter were derived. As a result of modifications made during the Mark I

Program, the gross volume was recalculated by more precise methods as described below.

The vent pipe area is equal to the design accident flow area divided by 0.0194, in accordance with the Bodega Bay test results. As noted in Section 6.2.1.3.2, the equivalent break flow area is 5.62 square feet, which would therefore result in a vent flow area of 5.62/0.0194 = 290 square feet. The as-installed design consists of eight vent pipes having a total minimum area of 286 square feet. This area results in the peak drywell containment pressure following the accident as discussed in Section 6.2.1.3.2.

The entrance area around the jet deflection baffles from the drywell to the vent pipes is a minimum of 1.4 times the vent pipe area to minimize entrance losses.

Vent pipe entrance area = 1.4 x 286 = 400 ft^2

Subsequent to the initial design calculations, as a result of the Mark I Containment Program, the following values have been established for the suppression chamber:

Gross volume of suppression chamber	245,400 ft^3
Downcomer submergence	3.67 ft to 4.0 ft
Water volume	116,300 ft^3 to 119,800 ft^3
Air volume	112,800 ft^3 to 116,300 ft^3
Structural material volume	12,100 ft^3
Volume associated with 1.0-psi drywell-to-suppression chamber differential pressure	700 ft^3

The revised gross volume of the suppression chamber (245,400 ft^3) was calculated based on actual as-constructed dimensions. The water volumes were calculated based on water levels corresponding to a downcomer submergence of 3.67 feet to 4.0 feet, as analyzed in the Mark I Containment Program. The structural material volume was calculated based on the Mark I modifications and the removal of suppression pool baffles. A differential pressure of 1.0 psi between the drywell and the suppression chamber, which was established during the Mark I program as an operational requirement to mitigate hydrodynamic loads, results in a 700-cubic foot displacement of suppression pool water. Based on these values, the remaining air volume was established.

In conjunction with the Mark I Containment Program, a plant unique structural analysis [7] was performed for Dresden Units 2 and 3. This analysis was based on pool swell loads [8] determined from plant unique tests. These tests were based on a downcomer submergence of 3.67 — 4.00 feet. The suppression chamber water and airspace volumes corresponding to these submergences were taken from the FSAR as 112,203 — 115,655 ft^3. Modifications were performed based on these analyses to restore the margin of safety required in the original containment design.

After completion of the Mark I Containment Program, it was determined that the water volumes specified in the plant unique load definition [8] and the plant unique analysis[7] actually correspond to a downcomer submergence of 3.21 to 3.54 feet at zero differential pressure. An evaluation concluded that affected components were still within the allowables established for the Mark I Containment Program[9]. This evaluation concluded that the present volume, corrected for the 1.0 psid overpressure in the drywell, does not adversely affect the existing analyses, and that the maximum component stresses reported in the plant unique analysis are still valid and meet the criteria of NUREG-0661. See Section 6.2.1.3.6.2 for additional discussion of the Mark I acceptance criteria. Refer to Section 6.2.1.3.6.4.2 for a description of the details of the reevaluation.

6.2.1.3.2 Containment Response to a Loss-of-Coolant Accident

In order to identify containment response to a loss of coolant (LOCA) accident, several analyses were performed. These analyses were performed to evaluate the containment short-term and long-term pressure and temperature response following the Design Basis Accident (DBA) LOCA. Short-term is defined as a time period from the beginning of the DBA LOCA to 600 seconds. There is no credit taken for operator actions during this short-term interval. Long-term is defined as a time period after short-term, namely from 600 seconds into the event, at which time the operator takes actions to initiate containment cooling or to control pump flows.

6.2.1.3.2.1 Containment Short-Term Response to a Design Basis Accident

The spectrum of postulated break sizes with respect to reactor core response is discussed in Section 6.3.3.2. The following information covers the effects of a LOCA on the containment, with particular emphasis on the most severe break: the doubled-ended rupture of one of the 28-inch-diameter recirculation pump suction lines. For the purpose of sizing the primary containment, an instantaneous, circumferential break of this line was hypothesized. The LOCA involving the recirculation pump suction line would occur upstream of point 1 on Figure 6.2-14.

reasons described below), is less than 10^{-7} per reactor-year. However, the PUAAG and NUREG-0661 required that an additional structural assessment be performed to demonstrate that the containment can maintain its functional capability when the differential pressure control is out of service.

Figures 6.2-27 and 6.2-28 show the resulting pressure-time history at selected locations on the torus shell for the situation when the operating differential pressure between the drywell and torus is 1 psid. These results are based on plant unique QSTF test data and include the effects of the generic spatial distribution factors as well as the conservatism factors on the peak upward and downward loads. Pool-swell torus shell loads consist of a quasi-static internal pressure component and a dynamic pressure component and include the effects of the DBA internal pressure.

At zero ΔP between the drywell and torus, the pool-swell phenomena are the same as for the operating ΔP case. Figures 6.2-29 and 6.2-30 show the resulting pressure-time history. These results were calculated on the same basis as the operating ΔP results.

Although the existence of a differential pressure between the drywell and torus is safety related, the system used to develop the differential pressure need not be designed to engineered safeguards criteria because it does not perform a post-accident function. The design requirements established for the differential pressure control system ensure that the system will not increase either the probability or the consequences of an accident.

There are certain periods during normal plant operation when the differential pressure control cannot be maintained. Therefore, limiting conditions for operation (LCOs) have been established in the Technical Specifications of the license to ensure that these periods are minimized.

6.2.1.3.6.4.2 Loss-of-Coolant-Accident Load Analysis Results

As a result of the Mark I Program, peak pressure and temperature loads on the containment structure were reevaluated for various SBA, IBA and DBA scenarios. Basic assumptions used for this reanalysis are listed in Table 6.2-5. These analyses accounted for a downcomer submergence of 4 feet, drywell-to-torus differential pressure (see Section 6.2.1.3.6.4.1), and a revised torus airspace free volume. Results of these calculations are shown graphically in Figures 6.2-31 through 6.2-38.

As previously noted in Section 6.2.1.3.1, the torus airspace free volume assumed for the Mark I Program containment peak pressure and temperature reanalysis (listed in Table 6.2-5) was incorrect. To verify that the results of the Mark I Program are valid, an evaluation of the effect that the revised torus air and water volumes have on the peak containment pressure and temperature was conducted. It was found that the slightly smaller torus air volume both reduces the initial torus air mass and reduces the final volume for the total initial containment air maintain the building at a slight negative pressure under both normal and accident conditions. This negative pressure is maintained for outside winds of any velocity or direction, and precludes exfiltration from the building.

The wind velocity pressure, or stagnation pressure was correlated by the following equation.[35]

$P_s = AV^2$

where:

A = proportionality constant

P_s = stagnation pressure

V = wind speed, mph

The leakage rate tests at low pressure differentials indicate that leakage rates may be correlated by the following equation:[36]

Leakage rate = $a(\Delta P) + b(\Delta P)^{1/2}$

where "a" and "b" are constants which are dependent upon the leakage characteristics of the building and ΔP is the pressure differential between the building atmosphere and the outside.

The model used to calculate reactor building inleakage assumes that two adjacent sides of the building are exposed to the wind, and that two adjacent sides are on the leeward side of the building. On the windward side of the structure, the stagnation pressure varies from approximately 50% to 90% of the wind velocity pressure. Thus, in the model the static pressure acting on the two adjacent sides on the windward side of the building is considered to be 90% of the wind stagnation pressure. On the leeward side of the building, the negative static pressure adjacent to the building siding varies from 30% to 60% of the wind velocity pressure, therefore the negative static pressure acting is considered to be 50% of the wind velocity pressure. The above model represents the worst possible differential effect on the building since component effects of the wind velocity vector are not considered.

Using the above criteria, the calculated building leakage is then predicated on maintaining a building pressure which is ¼ in.H_2O negative with respect to the external pressure on the leeward side of the building. Total leakage rates combine effects of leakage through the reactor building siding; personnel access doors; equipment access doors; and the electrical, vent, duct, and piping penetrations.

Table 6.2-8 lists the building leakages under various wind velocities from specific areas and for the total structure. The basis for the 477 ft^3/min leakage at zero wind speed is a summation of air infiltration from all potential leak paths, considering a ¼ in.H_2O differential pressure across these paths. At wind velocities

6.2.5 Combustible Gas Control in Containment

The primary means of containment combustible gas control is the nitrogen inerted containment. The inerted containment is sufficient to ensure peak combustible gas concentrations are below acceptable limits without the need to purge or repressurize the containment. In addition, the following criteria are met:

A. Drywell oxygen is limited to less than 4% (per Technical Specifications);

B. Only nitrogen or recycled containment atmosphere is used for pneumatic control within containment; and

C. There are no potential sources of oxygen into containment other than radiolysis of the reactor coolant.

As such, reliance on a purge/repressurization system is not necessary.

In addition, various containment atmosphere control systems are installed which are capable of providing venting and nitrogen makeup during normal operation and post-loss-of-coolant accident (LOCA) conditions. In the event of a post-LOCA combustible gas mixture, the existing purge systems can be used to vent this mixture out of the containment through the charcoal beds and high efficiency particulate air (HEPA) filters of the standby gas treatment system (SBGTS). The nitrogen makeup system and nitrogen inerting system are capable of adding nitrogen to the containment, thus reducing the combustible gas concentration. This section describes the systems available for combustible gas control at Dresden.

Refer to Section 6.2.1.3.7 for a discussion of the sources of hydrogen in the containment and the containment capability to handle the hydrogen generated.

6.2.5.1 Historical Basis for Combustible Gas Control System Design

The potential generation and control of hydrogen within the containment following a LOCA has been a concern since the first nuclear power plant was constructed. However, it was not until 1971 that the AEC documented its acceptance criteria for combustible gas control in Safety Guide 7, "Control of Combustible Gas Concentrations in Containment Following a Loss-of-Coolant Accident." One of the criteria stated in the guide was the amount of zirconium metal-water reaction that was to be considered as part of the hydrogen production analysis; specifically 5% by weight of the zirconium within the reactor core was selected as the upper limit. It switched in, the core cooling equipment would be reduced to one core spray and two LPCI's, which provide in excess of 100% DBA LOCA core cooling.

The HPCI room 125-V annunciation circuit has been modified to provide a means to monitor the status of both the main and reserve bus feeds. Should the dc feed auto-transfer, it would alert the operator if the reserve bus is deenergized.

Loss of the turbine building reserve bus 2 (or the Unit 3 battery or turbine building main bus 3) will result in the loss of control power to switchgear 24, 24-1, and 29, and to DG 2. As described above, only half of the control power is temporarily lost.

Control power failure to redundant buses and/or DGs can be affected only by the concurrent loss of the combined turbine building main bus/reactor building distribution panel and the turbine building reserve bus. Concurrent failure due to an electrical fault is prevented by keeping the bus tie breakers open during normal operation. The two turbine building buses are located within the same Class 1 structure that houses the control room and auxiliary equipment room. The same fire and missile protection afforded to control room panels is applied to the turbine building dc equipment. The physical separation of the turbine building reserve bus and the reactor building distribution panel will preclude concurrent mechanical damage to both buses.

Alternating current transfer devices meet single failure criteria as designed. The only dc transfer devices are used for control power to the DG 2/3, HPCI, and ADS, and their failures could cause loss of only those respective systems.

The emergency power system is designed so that an overload of any magnitude less than that expected from a direct phase-to-phase fault will not trip breakers or cause performance of any automatic functions. Overcurrent relays are provided which will isolate a fault on buses 23, 23-1, 24, or bus 24-1 when offsite power is available. Should the fault be on bus 23-1 or bus 24-1, these relays will also prevent the DG breakers from closing into the fault after offsite power has been isolated. Similar protection is provided for Unit 3.

Overload protection is not provided for those situations when onsite emergency power is being utilized; however, a kilowatt overload alarm is furnished with each DG which will alert the operator to a potentially hazardous situation.

It is concluded that the redundancy achieved by the dual battery systems, both the safety related 250-Vdc and the 125-Vdc, and by the DG arrangement, in addition to separation employed in all components, transfer devices, etc., assures that no single failure can prevent operation of the ESFs. The worst single failure would result in the loss of one-half of the core cooling equipment, i.e., one core spray pump and two LPCI pumps would become inoperable. One core spray pump and two LPCI pumps would remain operable to cool the core. In addition it is noted that the switchover capability in each of the battery systems permits the operator to supply battery power to a unit even if that unit's battery has failed.

The load capacity of each battery is monitored by a load tracking database and is sufficient to supply power to both units, even in the case that one unit has sustained an accident and the other unit is being shutdown.

All major instrument air system components except those associated with the 3C compressor train are located at elevation 517'-6" in the turbine building. The 3C compressor train is located on the Unit 3 538'-0" elevation. Unit 2 has two compressor trains, 2A and 2B; Unit 3 has three, 3A, 3B, and 3C. Each train consists of a compressor, an aftercooler, air receiver tanks, dryers, prefilters, afterfilters and the necessary control and support equipment (see Figures 9.3-1 through 9.3-4).

The instrument air system supplies air to:

A. Turbine building loads,

B. Reactor building loads,

C. Radwaste building loads,

D. Crib house loads, and

E. Off-gas filter building loads.

The 2A and 3A compressors are single-stage reciprocating air compressors powered by 60-hp electric motors. Each compressor is rated for 200 ft^3/min at 125-psig discharge pressure.

The 2B instrument air compressor is a two-stage, water cooled, 100-hp electric motor driven screw compressor, which delivers oil-free, pulsation-free air. This compressor is rated at 460 ft^3/min at 100-psig discharge pressure. The compressor will operate on the compressor pressure switch to load and unload and has no interlock with the Unit 2 instrument air main receiver pressure.

The 3B instrument air compressor is a two-stage reciprocating air compressor powered by a 100-hp electric motor. The 3B compressor is rated at 400 ft^3/min at 125-psig discharge pressure.

The 3C instrument air compressor is a rotary screw compressor capable of providing 460 ft^3/min at 100-psig discharge pressure to Units 2 and 3.

Cooling for all compressors is provided by the turbine building closed cooling water (TBCCW) system.

The instrument air supply system is operable at all times during plant operations. With the compressor in NORMAL mode and set to RUN, the following sequence occurs:

A. The instrument air compressor starts and runs unloaded (magnetic unloader deenergized);

B. If after a predetermined time the main receiver pressure is less than a predetermined setpoint, the magnetic unloader energizes and loads the compressor;

C. The instrument air compressor runs loaded until the proper main receiver pressure is established. At that time the magnetic unloader deenergizes and the compressor unloads; and

D. The instrument air compressor continues to load and unload as the main receiver commands until it auto trips, the control switch is placed to OFF, or the breaker opens.

Instrument air receivers are used as buffers between compressor discharge and the rest of the system. In this configuration, they dampen pressure pulses from the compressor and provide a smooth flow of air to the system. They also provide storage capacity to accommodate intervals when demand exceeds the capacity of the compressors.

Relief valves are set as follows:

A. Compressor discharge — 135 psig,

B. Local air receivers — 135 psig, and

C. Main air receivers — 125 psig.

The service air crosstie provides instrument air backup from the service air header. It operates automatically when instrument air pressure falls below 85 psig. Once operated, it must be manually reset when the air pressure is again greater than 85 psig. A control room alarm is provided to indicate low instrument air pressure.

9.3.1.2.2 Safety Evaluation

The postulated worst-case scenario for instrument air failure was identified as an event that would cause a total loss of instrument air as a result of a nonsafety-related system failure. Total loss of instrument air would cause a forced power reduction or plant shutdown, but all safety-related devices requiring instrument air would perform as designed.

Safety-related equipment design considers properly sized air accumulators as an effective means to supply residual air, pressurized nitrogen as an alternate motive force, and selection of appropriate component fail-safe positions to demonstrate acceptable consequences of the loss of air. The instrument air system provides high-quality air (i.e., free of moisture, particulates, and oil), thereby minimizing the potential for safety-related valve failure resulting from a lack of air due to blocked air supply lines. The station's air quality monitoring and preventative maintenance programs ensure that consistently high-quality instrument air is supplied.

In addition to these design features and administrative controls, the Unit 2 and 3 instrument air systems can be cross-connected during those rare occasions when one air compressor becomes unavailable and there is an unusually high and sudden demand on the instrument air system. Under normal circumstances one unit's air system is isolated from the other unit's with the exception of the 3C compressor, which may be aligned with either unit's system for additional support. Typically, the 3C compressor is aligned to Unit 2 to support the additional house loads on that system. This dedicated configuration isolates failure events and prevents them from affecting another dedicated system.

pump trip alarms in the control room, and remotely, on the generator relay and metering panel. A restriction orfice-type flow indicator is also provided in the DGCW pump discharge line in accordance with Regulatory Guide 1.97.

The Unit 2 pump receives electrical power from 480-V motor control center (MCC) 29-2. The Unit 3 pump receives electrical power from MCC 39-2. The 2/3 DGCW pump normally receives power from MCC 28-3, but an automatic device connects the pump to MCC 38-3 (Unit 3) if MCC 28-3 is deenergized. The pumps can be operated in manual mode or in automatic start mode. In the event of a loss of offsite power, the pumps are connected to the DG bus.

Each DG can operate without cooling water for 3 minutes at full load with a speed of 900 rpm assuming an initial cooling water temperature of 100°F prior to engine start. The DG operating time increases to 10 minutes with no load on the generator (at 900 rpm). At its idling speed each diesel generator can run for 42 minutes without cooling water, again assuming an initial water temperature of 100°F.

9.5.6 Diesel Generator Starting Air System

The purpose of the diesel generator (DG) starting air system is to store and deliver sufficient air to start the diesel under all conditions. The safety function of the air start piping is to provide a means to start the diesel engine in case of a loss of offsite power.

The DGs are started by air-driven starting motors. A separate starting air system is provided for each DG. Each DG starting air system has two starting air compressors and two air-driven starting motors. If the starting solenoid valve is energized, two air-driven starting motors engage a flywheel ring gear. After the two air-driven starting motors engage, the air start relay valve opens and four air receiver units supply the air which cranks the starting motors. Two air compressors maintain the air receiver pressure at greater than or equal to 220 psig. At an engine speed greater than 200 rpm, the starting solenoid valve deenergizes, interrupting the air to the starting motors and venting off the pressure which causes the air motors to stop and disengage. If the air receiver pressure is reduced to 175 psig, sufficient pressure would remain to start the DG once with no air compressor action. A diagram of diesel starting air piping is shown on Figure 9.5-10 (Drawing M-173). The safety-related portion of the system is shown on Figure 9.5-10.

Some minor modifications to the DG starting air system resulted from design concerns raised by the Dresden Safety System Functional Inspection (SSFI). These concerns have been addressed in the "Operability Assessment of SSFI Report Concerns".[2] The modifications have enhanced the DG starting air system, and have been implemented on the Unit 2 and Unit 3 DGs and the Unit 2/3 swing diesel generator. These modifications included the following:

A. Addition of a single 1½-inch check valve to the combined discharge header of both air receiver units in each starting air train;

prepared by the Radiation Protection Department in accordance with station procedures.

which the basic question is not what action is required to correct the condition but rather how to accomplish a desired action or achieve a desired condition.

13.5.2.1.2 General Operating Procedures

General Operating Procedures (DGPs) detail steps required to conduct unit startup and shutdown, actions to be taken following a reactor scram, steps essential for routine power changes, and guidance for control rod movement.

13.5.2.1.3 General Abnormal Procedures

General Abnormal Procedures (DGAs) describe actions to be taken by personnel either in the control room or in the plant during accident conditions to preclude violation of Technical Specification safety limits, core damage, degradation of primary containment integrity, or a threat to the health and safety of the public. These procedures are oriented toward a symptomatic response rather than a scenario response to accident conditions.

13.5.2.1.4 System Operating Abnormal Procedures

System Operating Abnormal Procedures (DOAs) describe actions to be taken during system transients (analyzed or expected) that require immediate operator actions to protect personnel and equipment or to avoid a plant transient. Immediate operator actions are those actions that can be performed from the control room and that must be accomplished within the first 2 or 3 minutes following initiation of a transient.

13.5.2.1.5 Emergency Operating Procedures

Emergency Operating Procedures (DEOPs) govern plant operation during conditions of uncertainty and prescribe actions to return the plant to a safe and stable condition. These procedures include incorporation of human factors principles, precision limits of installed instrumentation, consistent format of support procedures, and multi-disciplinary involvement and maintenance of DEOPs.

13.5.2.1.6 Annunciator Procedures

Annunciator Procedures (DANs) detail setpoints, automatic actions, and operator actions necessary for response to a condition annunciated at an alarm panel.

13.5.2.2.8 Security Procedures

Security Procedures (DSPs) detail the steps necessary to implement the Security Plan.

13.5.2.2.9 Fuel Handling Procedures

Fuel Handling Procedures (DFPs) implement the nuclear procedures. They detail steps necessary to perform core alterations; to inspect, receive, and handle new fuel; to handle and ship spent fuel; and to perform activities within the spent fuel pool, within the new fuel storage vault, and on the refueling floor.

13.5.2.2.10 Fire Protection Procedures

Fire Protection Procedures (DFPPs) detail operation of the fire protection systems.

13.5.2.2.11 Safe Shutdown Procedures

Safe Shutdown Procedures (DSSPs) are classified by specific procedure paths based upon location and extent of damage. They provide guidelines for bringing the reactor to a cold shutdown condition using a minimum number of components during severe fire conditions.

13.5.2.2.12 High Radiation Sample Building Procedures

High Radiation Sample Building Procedures (DSBPs) detail steps for obtaining normal and post-accident chemistry samples from the high radiation sample system.

13.5.2.2.13 Technical Staff Procedures

Technical Staff Procedures (DTPs) establish programs dealing with technical concerns, detail the collection of data for required reports, and control the calibration of technical staff instrumentation.

13.5.2.2.14 Contingency Procedures

Contingency Procedures (DXPs) detail the steps necessary to implement the safeguards contingency plan.

13.5.3.2 Electrical Surveillances

Electrical Surveillances (DESs) provide for verification of operability or performance characteristics of systems/equipment; performance of periodic checks, inspections, tests, and analyses; performance of periodic calibrations; performance of maintenance tasks that are expected to prevent malfunctioning of equipment; and compliance with commitments to documents (e.g., the Technical Specifications).

13.5.3.3 Fire Protection Surveillances

Fire Protection Surveillances (DFPSs) provide for verification of operability or performance characteristics of systems/equipment; performance of periodic checks, inspections, tests, and analyses; performance of periodic calibrations; and performance of maintenance tasks that are expected to prevent malfunctioning of equipment.

13.5.3.4 Instrument Surveillance Procedures

Instrument Surveillance Procedures (DISs) detail steps for regularly scheduled instrument surveillances and calibrations.

13.5.3.5 Mechanical Surveillances

Mechanical Surveillances (DMSs) provide for verification of operability or performance characteristics of systems/equipment; performance of periodic checks, inspections, tests, and analyses; performance of periodic calibrations; performance of maintenance tasks that are expected to prevent malfunctioning of equipment; and compliance with commitments to documents (e.g., the Technical Specifications).

13.5.3.6 System Operating Surveillance Procedures

System Operating Surveillance Procedures (DOSs) ensure the operability of systems required by Technical Specifications, detail steps for verifying operability of systems required for plant operation, and detail steps for checks that are required to be performed on a regularly scheduled frequency.

13.5.3.7 Radiation Protection Surveillances

Radiation Protection Surveillances (DRSs) provide for scheduling of periodic checks, inspections, tests, and analyses; periodic calibrations; and maintenance tasks that are expected to prevent malfunctioning of equipment such as effluent and discharge monitors. These surveillances also schedule tasks that satisfy commitments to documents (e.g., Technical Specifications).

13.5.3.8 Technical Staff Surveillance Procedures

Technical Staff Surveillance Procedures (DTSs) describe regularly scheduled surveillances that require engineering expertise to accomplish or that should be performed under the cognizance of an engineer.

13.5.3.9 Non-Station Work Group Procedures

Non-station work group procedures are procedures which govern work performed at Dresden and which are either prepared by onsite contractors, by CECo departments located offsite, or are prepared by station personnel to address activities which are not controlled by station procedures (e.g., fire pre-plans). The station may use non-station work group procedures once they are reviewed in accordance with the applicable administrative procedure.

K_c = K + 2
K = $3(S/d)^{1.4}$
A = cross-sectional area of the building
U = wind speed

This formulation was derived from the Halitsky data[33] in Figure 37 from Murphy's paper.[32] The Halitsky data were from wind tunnel tests on a model of the EBR-II rounded (PWR-type) containment and the validity of the data was limited to 0.5 <s/d <3. The origin and reason for the +2 in K + 2 is not known. All other formulations use K only, and for the situation where K is less than 1, the use of K + 2 imposes an unrealistic limit on the X/Q.

For the Dresden plant, the building complex is composed of square-edged buildings and not a round-topped cylindrical containment as was used in the Halitsky experiments. For an HVAC intake located near the south wall of the control building at elevation 549'-0", the intake will be subject to a building wake caused by a combination of the reactor building and the turbine building for any bypass leakage escaping from the turbine building. There is no reactor building bypass leakage because the building is kept at a negative pressure by the SBGTS which exhausts to the main chimney.

Because the Murphy methodology could not be applied, a survey of the literature was undertaken. It was found that the Halitsky wind tunnel test data[33] conservatively over estimated K_c values "by factors of up to possibly 10." Given this conservatism, use of a reasonable K_c value from the Halitsky data on square-edged buildings was deemed acceptable. A review of Figure 5.27 from the Halitsky data[33] resulted in K_c values in the 0.5 to 2 range. A value of K_c = 2 was chosen to determine a X/Q for the control room. A building cross-sectional area of 1550 square meters was conservatively used. This area corresponds to a projected area of one reactor building above grade. The use of a 1550 square meter area is very conservative because both the reactor buildings are adjacent to each other and the combined projected area could be larger than the value used. Information from other sources, as indicated in the following, has also shown that the 1550 square meters is a conservative value.

In a paper by D.H. Walker, et al.,[34] control room X/Qs were experimentally determined for floating power plants in wind tunnel tests. Different intake and exhaust combinations were considered. Using the data for a particular intake and exhaust combination, X/Q values of 1.77×10^{-5} and 2.24×10^{-5} were found after adjusting the wind speed from the 1.5 m/s to 1 m/s. These values are approximately two orders of magnitude lower than the conservatively calculated value for Dresden.

In a wind tunnel test by R.N. Hatcher, et al.,[35] a model industrial complex was used to test dispersions due to a wake. Data obtained from these tests show that K_c has a value less than 1, and it decreases as the test points are moved closer to the structure. In a study to determine optimum stack heights, R.N. Meroney and B.T. Yang[36] show that for short stacks (six-fifths of building height), K_c reaches a value of approximately 0.2 and decreases closer to the building. They concluded that the Halitsky methodology was overly conservative. These recent experimental tests show that K_c = 2 used to determine the X/Q for Dresden is a conservative estimate by at least a factor of 2 and possibly by a factor of 10 or more.